PATENT ABSTRACTS OF JAPAN

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(54) **PICTURE DISPLAY DEVICE**

(57)Abstract:
PURPOSE: To restrain a medical trouble from occurring in the case a spectacles type display is used for a long time.
CONSTITUTION: Marks expressing a virtual image display position 1m3m and ∞are displayed on the outer periphery of a virtual image position adjusting knob 18. When a user adjusts the mark 18A of the knob 18 to a position corresponding to a specified marka virtual image is displayed at a display position corresponding to the mark. Thusthe user more easily recognizes the virtual image display position in a use state and the medical trouble occurring because the spectacles type display is used for a longer time than required is restrained.

CLAIMS

[Claim(s)]
[Claim 1]An image display device comprising:
An image display means which displays a picture.
An optical means which generates optically a virtual image of a picture currently displayed on said image display means.
An adjustment device which adjusts a position of said virtual image.
A position representation means to display a position of said virtual image.

[Claim 2]The image display device according to claim 1wherein said position representation means is formed near said adjustment device.

[Claim 3]The image display device according to claim 1wherein said position representation means is formed in said image display means.
[Claim 4]The image display device according to claim 12or 3wherein said position representation means displays a position of said virtual image in a size of a screen corresponding to said virtual image.
[Claim 5]The image display device according to any one of claims 1 to 4 having further an announcement means which notifies of change of said virtual image position with a sound when a position of said virtual image is adjusted with said adjustment device.
[Claim 6]The image display device according to any one of claims 1 to 5 having further a medical displaying means which performs a medical display corresponding to a position of said virtual image.
[Claim 7]A position of said virtual imageand the image display device according to any one of claims 1 to 5 having further a control means which controls a power supply corresponding to the display time.
[Claim 8]A position of said virtual imageand the image display device according to any one of claims 1 to 5 having further a control means which controls a position of said virtual image automatically corresponding to the display time.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention is usedfor examplewhen displaying the so-called picture of a virtual reality on a glasses type displayand it relates to a suitable image display device.
[0002]
[Description of the Prior Art]These daysthe game device adapting a virtual reality attracts attention. This device carries a glasses type display in a headand usually displays a three-dimensional picture on that glasses type display. The user can see with the **** feeling of whether to actually experience this three-dimensional picture on one's life space. As a resultthe game which was more rich in presence can be enjoyed.
[0003]
[Problem(s) to be Solved by the Invention]By the wayif such a glasses type display is used for a long timehe has a headache or it is pointed out that it is not so good for eyes.
[0004]Howeverin the conventional devicethe consideration to the problem such of medical received ** crack ********the user received the problem of medicaland even though it coped with itthe technical problem that it was hard to do the

management occurred.
[0005]This invention is made in view of such a situationand tends to be made to carry out management to the problem of medical.
[0006]
[Means for Solving the Problem]This invention is characterized by an image display device comprising the following.
An image display means which displays a picture (for exampleLCD12 of drawing 2).
An optical means which generates optically a virtual image of a picture currently displayed on an image display means (for exampleaspheric surface lens 14 of drawing 2).
An adjustment device which adjusts a position of a virtual image (for examplevirtual image position regulation knob 18 of drawing 2).
A position representation means to display a position of a virtual image (for examplesignssuch as 1m3m of drawing 9and infinity).

[0007]A sign which displays a position of virtual imagessuch as 1m3mand infinitycan be formed near the virtual image position regulation knob 18. Or displaying on LCD12 which displays a picture again is also possible. A virtual image position can also be displayed as a size of a screen corresponding to a virtual image.
[0008]When a position of a virtual image is adjusted with the virtual image position regulation knob 18an announcement means (for exampleearphone 31 of drawing 2) which notifies of change of a virtual image position with a sound can be established further.
[0009]A medical displaying means (for exampleStep S3 on a program of drawing 13S4) which performs a medical display corresponding to a position of a virtual image can be established further. Corresponding to a position and display time of a virtual imagea control means (for exampleStep S59 on a program of drawing 17 or Step S39 on a program of drawing 16) which controls a position of a power supply or a virtual image automatically can be established further.
[0010]
[Function]In the image display device of the above-mentioned compositionsignssuch as 1m3minfinityetc. which display the position of a virtual imageare displayed near the virtual image position regulation knob 18 which adjusts the position of a virtual image. Thereforethe user can always check the position of the virtual image which he is looking at in the device used nowand it becomes possible to control the problem of medical more easily in one's volition.
[0011]
[Example]Drawing 1 is a block diagram showing the composition of one example of the image display device of this invention. The control unit 51 comprises a microcomputer etc.for examplecontrols each partand performs the function as an image display device. The memory 52 built in the control unit 51 comprises RAM or a ROMfor

examplethe predetermined image data about a game is memorized beforehand.
[0012]When the memory 52 is constituted as RAMpredetermined data is read from CD-ROM with which the reading section 54 was equippedfor exampleand it can be made to memorize there. When the memory 52 is constituted as a ROMit is able to make this into a card system and to enable it to exchange it comparatively simply.
[0013]The reading section 54 is equipped with the memory unit 55 which consists of CD-ROMsfor example.
Voice data is memorized there.
Of courseit is possible this voice data and to also make the memory 52 memorize.
[0014]The microphone 61 collects soundssuch as voice which a user generates. After the A/D conversion of the audio signal collected with the microphone 61 is carried out by A/D converter 62it is supplied to the sound generation unit 63. The sound generation unit 63 applies an echo to the voice data inputted from A/D converter 62or performs predetermined effect processingand it is compounded with the voice data supplied via a data bus from the memory unit 55and it outputs it.
[0015]The sound generation unit 64 performs and outputs predetermined effect processing to the voice data supplied from the memory unit 55. The synthetic circuit 65 compounds the voice data for loudspeakers which the sound generation unit 63 outputsand the voice data for earphones which the sound generation unit 64 outputsand outputs it to D/A converter 66. D/A converter 66 supplies the voice data for earphones which carried out D/A conversion of the inputted datasupplied the voice data for loudspeakers supplied from the sound generation unit 63 to the loudspeaker 67and was supplied from the sound generation unit 64 to the earphone 31.
[0016]Voice data supplied to this loudspeaker 67 and earphone 31 shall also be made into the same thingand shall differ. For exampleonly the sound from the memory unit 55 is outputted to the earphone 31and the sound from the memory unit 55 and the sound inputted from the microphone 61 can be outputted to it at the loudspeaker 67.
[0017]The image data for displaying on the monitor 75 among the image data memorized by the memory 52 is supplied to the image generation unit 71 via a data bus.
[0018]The position data which the position sensing device 87 outputs is also supplied to this image generation unit 71 again. The position sensing device 87 is attached to the glasses type display 86.
The data about the position in direction (horizontal direction) of the head of the user putting on the glasses type display 86direction (data showing whether the top is seen or the bottom is seen) of a perpendicular directionand space further predetermined [such as a room besides the position (position of a sliding direction) of the head] is outputted.

[0019]Corresponding to the output data of the position sensing device 87the image

generation unit 71 accepts necessityand chooses and amends the image data supplied from the control unit 51. The CG buffer 72 once accumulates the image data supplied from the image generation unit 71and outputs it to the converter 73. The converter 73 changes into the video signal of NTSC system the image data which consists of RGB dataand outputs it to the synthetic circuit 74.
[0020]In the message generation unit 76it is read from the memory 52 of the control unit 51the message (character) corresponding to the message code supplied via the data bus is generatedand the synthetic circuit 74 is supplied. The synthetic circuit 74 compounds the picture signal supplied from the converter 73and the picture signal supplied from the message generation unit 76and is outputting it to the monitor 75.
[0021]It is the data chosen as the image generation unit 81 from the control unit 51 with the key unit 53 among the data memorized by the memory 52and the image data for left eyes is supplied. And the position data which the position sensing device 87 detected is also supplied to this image generation unit 81. The image generation unit 81 chooses and amends the data supplied from the control unit 51 corresponding to the detected information of the position sensing device 87. And this amendment data is supplied to the converter 83 via the CG buffer 82. The converter 83 changes RGB data into the image data of NTSC systemand supplies them to the synthetic circuit 84.
[0022]The image generation unit 91the CG buffer 92and the converter 93 which process the picture for right eyes as well as the image generation unit 81the CG buffer 82and the converter 83 which process the picture for the above left eyes are formed. The output of the converter 93 is supplied to the synthetic circuit 84and it is made as [compound / with the data from the converter 83]. And the image data outputted from the synthetic circuit 84 is further supplied to the synthetic circuit 85and it is compounded with the picture signal of the message which the message generation unit 76 outputsand is made as [supply / the glasses type display 86].
[0023]Drawing 2 shows the more detailed composition of the glasses type display 86. This glasses type display 86 is fundamentally constituted by the main part 1 and Ring 2. The pad 3 is formed in the back side of the main part 1this pad 3 is pressed against a user's frameand it is made as [equip / it / with the glasses type display 86] with the feeling that people wear glasses exactlyby turning Ring 2 behind a head.
[0024]LCD12 which the back light 11 was formed in the main part 1and was provided one [at a time] in right and leftrespectively is illuminated from back. The picture signal for left eyes is displayed on LCD provided in left-hand side among LCD12and the picture signal for right eyes is displayed on LCD provided in right-hand side. It is reflected by the mirror 13 countered and formed in LCD12 of right and leftrespectivelyit is further reflected by the half mirror 15and the picture displayed on LCD12 is made as [enter / into the eyes of the user putting on this glasses type display 86]. At this timethe picture displayed on LCD12 for left eyes enters into a user's left eyeand the picture displayed on LCD12 for right eyes enters into a user's

right eye.
[0025]Between the mirror 13 of one pair of right and leftand the half mirror 15the aspheric surface lens 14 of one pair of right and left is formed.
the picture displayed on LCD12 for left eyes and LCD12 for right eyes is expandedrespectivelyand image formation is carried out to a user's eyes (a virtual image is displayed) -- it is made like.

[0026]The smoked glass 16 is formed in the front face of the half mirror 15enabling free rotation. If it changes into the state where the smoked glass 16 was opened wideas [show / in drawing 2]the user can see the external world via the half mirror 15 if needed. It is chosen automatically with which whether the picture of LCD12 reflected by the half mirror 15 is seen or the external world's being seenand a user double a focus. When it is not necessary to see the external worldthe picture of LCD12 can be more vividly seen by closing the smoked glass 16 and keeping the light from the external world from entering into the half mirror 15.
[0027]The interpupillary-distance regulation knob 17 is formed in the right lateral of the main part 1.
By adjusting this interpupillary-distance regulation knob 17a horizontal distance of one pair of aspheric surface lenses 14 arranged at right and left can be doubled with its interpupillary distancei.e.the distance of both eyes.

[0028]The virtual image position regulation knob 18 is formed in the central upper surface of the main part 1.
By carrying out rotational adjustment of this virtual image position regulation knob 18the distance of the optical axis direction of LCD12 and the aspheric surface lens 14 can be changed.
Therebya virtual image position can be adjusted (diopter adjustment). That isif this virtual image position regulation knob 18 is adjustedto a user's eyesthe picture currently displayed on LCD12 can be recognized as a picture which exists in the position 3 m away from itselvesor it can recognize to them as a picture which exists in the 1-m-away position. This distance can be adjusted by operating the virtual image position regulation knob 18.
[0029]D/A converter 10 is arranged between the mirrors 13 on either side. This D/A converter 10 outputs the electric power which drives the back light 11. Since the electric power which drives this back light 11 is high voltage comparativelyif it is arranged in the position separated not much from the back light 11it will become disadvantageous from a pressure-proof viewpoint. Thereforein the case of this exampleas shown in drawing 2it is near the back light 11 and is arranged between one pair of mirrors 13.
[0030]The headphone reel 21 is formed in the left and right laterals of Ring 2.
It is made as [roll / the code 32 of the earphone 31 on either side / suitably].

The D/D converter 22 is accommodated in the right lateral of Ring 2. This D/D converter 22 is for supplying direct current voltage required for each part of this glasses type display 86. The RG board 23 with which the circuit which processes a picture signalthe driver which drives LCD12etc. were accommodated is accommodated in the left lateral of Ring 2.
[0031]The remote control 33 is connected to the left lateral of this Ring 2 via the code 34. The user is made as [adjust / by operating this remote control 33 / the audio signal outputted to the earphone 31 and the picture displayed on LCD12]. The function of the key of this remote control 33 can be made to correspond with a part or all of the function of a key in the key unit 53.
[0032]Nextthe operation is explained. A user operates the predetermined button of the key unit 53and chooses a predetermined game. If such selection is performedthe control unit 51 will read the image data corresponding to this selection from the memory 52and will output it to the image generation units 7181and 91respectively.
[0033]If the start button of the key unit 53 is operatedthe reading section 54 will read the voice data corresponding to the game specified from the memory unit 55and will output it to the sound generation units 63 and 64.
[0034]The sound generation unit 64 performs predetermined sound-effects processing specified in the key unit 53 to the inputted voice data. D/A conversion of the voice data outputted from the synthetic circuit 65 is carried out by D/A converter 66and it is supplied to the earphone 31. Therebythe user can hear the sound about the game specified via the earphone 31.
[0035]Similarlythe sound generation unit 63 outputs voice dataand outputs to the synthetic circuit 65. After D/A conversion of the voice data for loudspeakers outputted from the synthetic circuit 65 is carried out by D/A converter 66sound emission of it is supplied and carried out to the loudspeaker 67. The sound of the game specified also from the loudspeaker 67 currently fixed to the position of the room (space) where the game device is arranged by this is outputted. Persons other than the user putting on the glasses type display 86 can hear the sound from this loudspeaker 67.
[0036]On the other handthe image generation units 81 and 91 process the picture for left eyes supplied from the control unit 51respectivelyand the image data for right eyesand output them to the converters 83 and 93 via the CG buffers 82 and 92. After the picture signal changed into the picture signal of NTSC system from RGB data by the converters 83 and 93 is compounded in the synthetic circuit 84it is supplied to the glasses type display 86 via the synthetic circuit 85. At this timein the synthetic circuit 85the picture signal of the message which the message generation unit 76 generated is compounded from the synthetic circuit 84 to a picture signal if neededand is supplied to the glasses type display 86. As a resulta picture and a message are displayed on LCD12 of the glasses type display 86.
[0037]At this timethe picture for left eyes processed by the image generation unit

81the CG buffer 82and the converter 83 is displayed on LCD12 for left eyesand the picture for right eyes processed by the image generation unit 91the CG buffer 92and the converter 93 is displayed on LCD12 for right eyes. The picture displayed on LCD12 of one pair of right and left currently illuminated with the back light 11 enters independently of the eye of a user's right and left via the mirror 13the aspheric surface lens 14and the half mirror 15respectively. The ingredient corresponding to azimuth difference is contained in the picture for left eyesand the picture for right eyesrespectively. As a resulta user will compound in the head the virtual image which enters into both this eyeand will recognize as a stereoscopic picture.

[0038]When it is not necessary to make it a stereoscopic pictureone side becomes unnecessary among the image generation units 81 and 91the CG buffers 82 and 92and the converters 83 and 93.

[0039]Thusthe picture of the game which the user chose is displayed on LCD12.

[0040]On the other handthe image data for displaying on the monitor 75 is supplied to the image generation unit 71 from the control unit 51. And in the synthetic circuit 74this image data is compounded [the picture signal and if needed] for a message which the message generation unit 76 outputsafter the converter 73 is supplied via the CG buffer 72 and changed into the picture signal of NTSC system. And it is outputted and displayed on the monitor 75.

[0041]Persons other than the user putting on the glasses type display 86 can see and enjoy the picture currently displayed on this monitor 75. Of coursethe user changes into the state where the smoked glass 16 was opened wideand he can observe the situation of the circumference besides the monitor 75 via the half mirror 15.

[0042]The picture displayed on this monitor 75 can also be made into the picture displayed on the glasses type display 86and the picture which differs although it is good also as the same. For examplethe glasses type display 86 can be made to display the picture of the user who is playing the game on the monitor 75 to displaying the picture of a game. And the user who set in that casefor examplehas carried the glasses type display 86 with the television camera is photoedand the picture signal is superimposed on the monitor 75and can be displayed.

[0043]On the other handif the user putting on the glasses type display 86 utters voice in predetermined timingafter a sound is collected with the microphone 61 and the A/D conversion of this voice is carried out from A/D converter 62it will be supplied to the sound generation unit 63. To the inputted voice datathe sound generation unit 63 gives a predetermined echo effect if neededand compounds it with the sound from the memory unit 55. And this sound and the compounded data are supplied and outputted to the loudspeaker 67 via the synthetic circuit 65 and D/A converter 66.

[0044]The glasses type display 86 is equipped with the position sensing device 87. The position data of the user putting on this glasses type display 86 is outputted. This position data is supplied to the image generation units 81 and 91. The image generation units 81 and 91 choose and amend the image data supplied from the

control unit 51 corresponding to these position data. Therebythe picture corresponding to a user's position is displayed on LCD12. That isa display image will also be changed into a vertical and horizontal picture if a user turns to four directions.

[0045]Drawing 3 expresses the principle to which the position of a virtual image is adjustedwhen the virtual image position regulation knob 18 is rotated and adjusted. As shown in the figuresuppose that LCD12 is in the position of position 12_A now. In order that a user may look at the picture currently displayed on this LCD12 via the aspheric surface lens 14he will look at virtual-image I_A.

[0046]In this statevirtual-image I_B of a position from which the user separated LCD12 more supposing it made it move to position 12_B which separated more from position 12_A to the aspheric surface lens 14 will be seen. That isif the virtual image position regulation knob 18 is adjustedaccording to the amount of adjustmentsthe position over the aspheric surface lens 14 of LCD12 will be adjustedand a virtual image position will change.

[0047]Or as shownfor example in drawing 4the position of a virtual image can be changed again also by fixing LCD12 to a position and adjusting the position of the aspheric surface lens 14 to LCD12. That iswhen the aspheric surface lens 14 is in position 14_Aa user will look at virtual-image I_A. On the other handif the aspheric surface lens 14 is moved to position 14_B which separated more from LCD12the user can see virtual-image I_B of the position which separated more.

[0048]As shown in drawing 3 and drawing 4the position of a virtual image can be changed by changing a relative distance of the aspheric surface lens 14 and LCD12. It can also be said that changing the position of a virtual image adjusts the virtual image position regulation knob 18 with changing the size of a virtual image since it is equivalentand the size (size of the screen where a virtual image corresponds) of a virtual image is adjusted.

[0049]Thusif a relative distance of LCD12 and the aspheric surface lens 14 is changedthe position (size of a screen) of the virtual image can be changedbut when the position of a virtual image is changedit is necessary to also change direction (angle of convergence) of LCD12 a little. That isas shown in drawing 5 (a)when the display position of a virtual image is farthe angle (angle of convergence) which the straight line which tends toward the center (the center of an eye on either side) of LCD12 of right and left from the display position of a virtual image makes is smallbut as shown in the figure (b)when the display position of a virtual image is brought close to LCD12an angle of convergence becomes larger. For this reasonwhen the display position of a virtual image is nearcompared with the case where it is farit is necessary to arrange LCD12 inside more. If it does in this waywhether it is when the display position of a virtual image is far or a user is when nearhe can observe a virtual image correctly.

[0050]Drawing 6 and drawing 7 show the example of concrete composition for changing the display position of a virtual image. The eccentric-cam board 162 is

formed in the virtual image position regulation knob 18 via the axis 161. This eccentric-cam board 162 is arranged in the cam groove 132d of the sliding plate 132. Thereforeif the virtual image position regulation knob 18 is rotated to a clockwise rotation or a counterclockwise rotationthe sliding plate 132 will move to the front or back (in drawing 6they are the direction of the lower leftor the direction of the upper right). This movement is guided by the pin 104c implanted in the frame 104 inserted in the long groove holes 132a and 132c currently formed in the sliding plate 132.
[0051]Since LCD12 currently held at LCD holder 124 and the back light 11 are attached behind the sliding plate 132by rotating the virtual image position regulation knob 18 after all. LCD12 will move to the front or back (in drawing 6they are the direction of the lower leftor the direction of the upper right). Namelyit is moved in the direction which approachesor the direction keeping away to the main part 121 of a unit of the optical vision unit 120 which has the mirror 13 and the aspheric surface lens 14. Therebyas shown in drawing 3the relative distance of LCD12 to the aspheric surface lens 14 is changedand the display position of a virtual image can be moved.
[0052]On the other handthe pin part 124c is formed in the lower part at LCD holder 124 on either siderespectively. This pin part 124c is inserted in the crevice 163c of the cam arm 163. And each crevice 163c of the cam arm 163 arranged at these right and left is seen from the upper surfaceand is arranged in the shape of [of Ha] a character. As a resultif LCD holder 124 on either side moves in the direction approaching the main part 121 of a unitit will be guided so that the pin part 124c on either side may move inside (in direction which approaches mutually). As a resultsince that lobe 124a is inserted in the shaft 136LCD holder 124 (thereforeLCD12 of the right and left currently held at it) on either side is guided to this shaft 136and is moved inside (in direction which approaches mutually).
[0053]On the contrarythe virtual image position regulation knob 18 is adjustedand if LCD holder 124 is moved in the direction which separates from the main part 121 of a unitLCD holder 124 (LCD12 of right and left) on either side will be moved in the direction which separates mutuallyrespectively. By thisthe angle of convergence shown in drawing 5 will be adjusted.
[0054]Drawing 8 shows the example of concrete composition for adjusting a mutual distance of the aspheric surface lens 14 on either sidewhen the interpupillary-distance regulation knob 17 is adjusted. As shown in the figurethe interpupillary-distance regulation knob 17 is combined with the cylindrical cam 141. This cylindrical cam 141 is held with the stop ring 142enabling the free rotation to the holder 107 of the aspheric surface lens 14. The cam-groove hole 141a is formed in the periphery of the cylindrical cam 141and the cam pin 144 implanted in the head 143a of the rod 143 is inserted in it at this cam-groove hole 141a. The base end 143b of the rod 143 is connected with the right-hand side aspheric surface lens 14.
[0055]Since the cylindrical cam 141 will rotate in one if the interpupillary-distance regulation knob 17 is rotated to a clockwise rotation or a counterclockwise

rotationThe cam pin 144 currently implanted in the head 143a of the rod 143 is guided to the cam-groove hole 141a of the cylindrical cam 141and moves the left or rightward in drawing 8 corresponding to the hand of cut of the interpupillary-distance regulation knob 17. As a resultit is shown to the attaching parts 121b and 121c by the shaft 105 to the aspheric surface lens 14 of the right-hand side where the rod 143 is connectedand it moves to a longitudinal direction.

[0056]As shown in drawing 8inside the aspheric surface lens 14 on either sidethe arm 154 is connectedrespectivelyand the long groove hole 154a is formed at the tip. And the pin 153 implanted in the both ends of the rotation lever 151 is inserted in this long groove hole 154a. And the center of the rotation lever 151 is supported by the pivot 152 currently implanted in the frame 104enabling free rotation. As a resultin drawing 8if the right-hand side aspheric surface lens 14 moves leftward in a figurethe arm 154 will also move leftward in a figure. Since the pin 153 inserted in the long groove hole 154a of that arm 154 is pressed leftward in a figure at this timethe rotation lever 151 makes the pivot 152 a fulcrumand it rotates clockwise.

[0057]As a resultin order that the pin 153 currently implanted in the opposite hand of the rotation lever 151 may rotate the pivot 152 clockwise as a centerthe arm 154 which has the long groove hole 154a in which the pin 153 is inserted is moved rightward. Thereforevia the attaching parts 121b and 121cthe left-hand side aspheric surface lens 14 is guided by the shaft 105and moves rightward. Namelythe aspheric surface lens 14 of right-hand side and left-hand side moves in the direction which approaches mutually.

[0058]If the interpupillary-distance regulation knob 17 is rotated to a counter direction and the rod 143 is moved rightwardthe aspheric surface lens 14 on either side will be moved in the direction which separates mutually.

[0059]Interpupillary-distance adjustment is performed as mentioned above.

[0060]If the main part 121 of a unit which accommodates the aspheric surface lens 14 moves in the direction which approaches mutually as mentioned above corresponding to the adjustment operation of the interpupillary-distance regulation knob 17or the direction which separatesas shown in drawing 7The pin part 121d currently formed in the main part 121 of a unit on either side is also moved in the direction which approaches mutuallyor the direction which separates.

[0061]If the pin part 121d on either side is moved in the direction which approaches mutuallythe cam arm 163 on either side in which this pin part 121d is inserted will also move in the direction which approaches mutually. And the cam-pin part 163b of the right and left currently implanted in the cam arm 163 on either siderespectively is also moved in the direction which approaches mutually.

[0062]The cam-pin part 163b of these right and left is inserted in the cam-groove hole 104e of the right and left currently formed in the frame 104 in the shape of [of Ha] a character. As a resultif the cam-pin part 163b on either side moves in the direction which approaches mutuallyit will rotate counterclockwise focusing on the pin

part 121dand the cam arm 163 shown in left-hand side in drawing 7 will rotate clockwise the cam arm 163 shown in the figure Nakamigi side. Since the pin part 124c of LCD holder 124 is inserted in the crevice 163c of the cam arm 163 as mentioned aboveLCD holder 124 on either side is moved in the direction which approaches more (it becomes large like [an angle of convergence]).

[0063]On the contraryif the aspheric surface lens 14 on either side is moved in the direction which separates mutuallythe cam arm 163 on either side will be rotated to a clockwise rotation or a counterclockwise rotation focusing on the pin part 121drespectivelyand LCD12 of right and left will be moved in the direction which separates mutually. Namelyan angle of convergence is adjusted in the direction which becomes small.

[0064]If the interpupillary distance is adjusted as mentioned abovea mutual distance of the aspheric surface lens 14 is not only adjustedbut a mutual distance of LCD12 will also be adjusted automatically and an angle of convergence will be adjusted.

[0065]Drawing 9 expresses the display example of the virtual image position regulation knob 18. In this examplethe sign (signssuch as 1m3mand infinity) with which a virtual image position is expressed to the circumference of the virtual image position regulation knob 18 is displayed. The user is made as [adjust / by rotating so that the mark 18A of the virtual image position regulation knob 18 may be doubled with a desired symbol display position / a virtual image position].

[0066]That isif the mark 18A of the virtual image position regulation knob 18 is doubled with the position as which the sign 1m is displayed for examplethe position of LCD12 will be adjusted so that the display position of a virtual image may be set to 1 m. If the mark 18A is doubled with the position of the sign 3m or sign infinitythe position of LCD12 will be adjusted so that an image display position may turn into a position of 3 m or infinity.

[0067]Drawing 10 expresses other display examples. That isin this examplethe display position of the virtual image is displayed as a size of a screen like not direct distancesuch as 1m3mand infinitybut 50 inches40 inchesor 30 inches. Also in this caseif the mark 18A of the virtual image position regulation knob 18 is doubled with the display position of a 50-inch signfor exampleLCD12 will be moved to the position in which a 50-inch screen is observed by the user. If the mark 18A is doubled with a sign (40 inches or 30 inches)LCD12 will be moved to a position equivalent to the case where the screen with a size of 40 inches or 30 inches is being seen.

[0068]The display position of these virtual images can also be displayed on LCD12as shownfor example in drawing 11 or drawing 12. In the example of drawing 11signssuch as 1m3m in drawing 9and infinityare not displayed on the circumference of the virtual image position regulation knob 18and corresponding to the rotary place of the virtual image position regulation knob 18as shown in drawing 11 (a) thru/or (c)they are made as [display / on LCD12 / directly].

[0069]In the example of drawing 12the numbers 5040and 30 showing the size of the

screen shown in drawing 10etc. are displayed on LCD12. At this timethe straight line which attaches and shows an arrow to both ends is simultaneously displayed on the position on the diagonal line of a screen so that a user can recognize intuitively that these numbers express the size of a screen. When a user rotates the virtual image position regulation knob 18corresponding to the rotary placea display as shown in drawing 12 (a) thru/or (c) will be displayed on LCD12.

[0070]Drawing 13 thru/or drawing 17 express the example of further others which displays an image display position.

[0071]In the example of drawing 13it is first judged in Step S1 whether change of an image display position was directed. That isthe control unit 51 is always monitoring whether the virtual image position regulation knob 18 was operated.

When the virtual image position regulation knob 18 is operatedit progresses to Step S2 from Step S1.

In Step S2it is judged whether it was operated in that operation of the virtual image position regulation knob 18 was operated in the direction which makes an image display position further than the presentor the direction which becomes near.

[0072]When the virtual image position regulation knob 18 is operated in the direction as for which an image display position becomes furtherit progresses to Step S3 and a predetermined voice message is outputted to it. That isthe control unit 51 controls the sound generation unit 64for examplemakes the voice message of "a screen becomes small"a display position becoming faretc. generate at this time. This voice message is outputted to the earphone 31 via the synthetic circuit 65 and D/A converter 66.

[0073]In Step S2when it judges that it was operated by the virtual image position regulation knob 18 in the direction which brings a virtual image closeit progresses to step S4 and the voice message corresponding to the manipulating direction is outputted. For examplethe control unit 51 makes "a screen becomes large" and the voice message "a display position becomes near" output to the earphone 31.

[0074]Thuscautions can be made to be turned more about an image display position (size of a screen) by demanding cautions from a user by a voice message to a user. Thereforeif it notifies beforehand in the operation manual etc. of there being a possibility that the problem of medical may occur when it is used for a long time (on big screen)where an image display position is brought closefor exampleSince a voice message is outputted whenever it changes the display position of a virtual imageit becomes possible more frequently to a user to make the attention over the problem of medical call.

[0075]In Step S3 or step S4when it progresses to Step S5it is judged whether instructions of the end of processing were inputted and instructions of the end are not inputted after a predetermined voice message is outputtedit returns to Step S1 and repeat execution of the processing after it is carried out.

[0076]On the other handin the example of drawing 14it is judged in Step S11 whether

the image display position was changed. And when judged with the display position of the virtual image having been changedit progresses to Step S12 and medical warning is performed. That isthe control unit 51 controls the sound generation unit 64for examplemakes the voice message "there is a possibility that the problem of medical may occur if it is used for a long time" generate at this time. And this voice message is made to output to the earphone 31 via the synthetic circuit 65 and D/A converter 66.

[0077]The message generation unit 76 is controlled and the same message is made to generate as a character. And output displaying of this character is carried out to LCD12 via the synthetic circuit 85. Of coursewarning with such a sound and warning with an image can also be considered as the either.

[0078]

[0079]In Step S13repeat execution of the above processing is carried out until it is ordered in the end of processing.

[0080]Although it is Step S11 and judged whether the image display position was changed in the example of this drawing 14For examplewhenever the predetermined time which judged whether predetermined time passed after the beginning of using of the glasses type display 86and was set up beforehand passesit is possible to make it also make medical warning perform. It is checked that there are few possibilities that the problem of medical may occur by use of 2 hours at 3 degrees in an angle of convergence.

[0081]When it stands by in Step S21 in the example of drawing 15 until change of an image display position was directedand change of an image display position is directedIt progresses to Step S22 and it is judged whether change of the image display position is change of that it is change of the direction which enlarges an angle of convergenceor a direction made small. When it is change of the direction which enlarges an angle of convergenceit progresses to Step S23 and predetermined medical warning is performed. For examplewarning "there is a possibility that the problem of medical may occur if it is used for a long time" is outputted to at least one side of earphone 31 and LCD12.

[0082]In Step S22when judged with it being change of the direction which makes an angle of convergence smallit progresses to Step S24 and a different medical warning from the case in Step S23 is performed. For examplewarning "avoid prolonged use if possible" is outputted to at least one side of earphone 31 and LCD12.

[0083]By thusthe case where an angle of convergence is enlarged (an image display position is brought close namelyused as a bigger screen) and the case where an angle of convergence is made small (an image display position is made farnamelythe size of a screen is made small). By making medical warning into the thing of a different kindit can control that warning gets into a rut.

[0084]In Step S25repeat execution of the above processing is carried out until it is ordered in the end of processing.

[0085]Drawing 16 expresses the example of further others. In this exampleit is first judged in Step S31 whether the image display position changed. When an image display position changes by operating the virtual image position regulation knob 18it progresses to Step S32 from Step S31and it is judged whether it is what makes it small whether it is that to which the change makes an angle of convergence larger than a predetermined reference value. When it is what makes an angle of convergence larger than a reference valuewhile progressing to Step S33 further and setting one to flag FAthe timer built in the control unit 51 starts. And it returns from Step S35 to Step S31and it is judged whether the image display position had change again.
[0086]Since it is judged with the image display position not changing in Step S31 after the adjustment operation of the virtual image position regulation knob 18 is completedit progresses to Step S36. It is judged in Step S36 whether one is set to flag FA. In nowone is set to flag FA in Step S33. Thereforeit progresses to Step S37 in this caseand it is judged whether the timer which started the time check in Step S33 clocked fixed time set up beforehand.
[0087]In Step S37it is judged whether when it judges that only the time which the timer set up beforehand has not passed yetit returns to Step S35 and it is ordered it in the end of processing. And when not ordered yet in the endit returns to Step S31 againand the same processing is repeated.
[0088]That isif the virtual image position regulation knob 18 is adjusted so that an angle of convergence may become larger than a reference valuerepeat execution of the processing of Step S31S36S37and S35 will be carried out. And when the predetermined time set up beforehand passesit progresses to Step S38 from Step S37and a compulsive change message is outputted. For examplethe message of "making an image display position far" is outputted to at least one side of earphone 31 or LCD12.
[0089]While progressing to Step S39 furthermore and resetting flag FALCD12 is moved compulsorily (automatically) so that a virtual image position may become further than a reference value (an angle of convergence becomes smaller than a reference value like). That isthe control unit 51 drives the motor 56 built in the glasses type display 86and makes a position carry out forcible movement of LCD12 at this time. As a resultuse [in / when an image display position is nearer than a reference value (when an angle of convergence is larger than the reference value set up beforehand) / the image display position (angle of convergence)]When it is restricted at fixed time set up beforehand and the device is used more than the timeit will be automatically moved to a position with a far image display position. Thereforeit becomes more certainly possible to control generating of the problem of medical.
[0090]If it progresses to Step S35 and the next of Step S39 is not ordered in the end of processingit returns to Step S31 againand repeat execution of the processing after it is carried out.
[0091]In Step S32when it judges that an angle of convergence does not become

larger than a reference valueit progresses to Step S34 from Step S32and medical warning is performed. That isas opposed to earphone 31 and LCD12the message "there is a possibility that the problem of medical may occur if it is used for a long time" is outputted. And in Step S35if not ordered in the end of processingit returns to Step S31 againand repeat execution of the same processing is carried out.
[0092]Since it progresses to Step S36 from Step S31 and flag FA is reset when the virtual image position regulation knob 18 is not operatedit returns to Step S31 againand repeat execution of the processing after it is carried out.
[0093]Drawing 17 expresses the example of further others. Processing of Steps S51 thru/or S57 in this example is the same processing as Steps S31 thru/or S37 in drawing 16. Howeverprocessing of Step S58 and S59 differs from processing of Step [in drawing 16] S38and S39.
[0094]Namelywhen the predetermined time set up beforehand passed after being changed in the example of drawing 16 so that an angle of convergence might become large beyond a reference valuechanged the displaying condition automatically so that a predetermined message might be outputted and an angle of convergence might become smallbut. It is Step S58 instead of switching a displaying condition in the example of drawing 17so that an angle of convergence may become smallFor exampleafter outputting the message of "turning OFF a power supply since fixed time passed" to earphone 31 and LCD12he turns off a power supply compulsorily and is trying to stop a display because of Step S59. And he is trying to also reset flag FA. If it does in this waygenerating of the problem of medical can be controlled further more certainly.
[0095]
[Effect of the Invention]Since the position of the virtual image was displayed on the position representation means like the above according to the image display device of this inventionit becomes possible to control generating of the problem of medical more certainly.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram showing the composition of one example of the image display device of this invention.
[Drawing 2]It is a perspective view showing the more detailed composition of the glasses type display 86 in drawing 1.
[Drawing 3]It is a figure explaining the principle which changes an image display position.
[Drawing 4]It is a figure explaining the principle which changes an image display position.

[Drawing 5]It is a figure explaining the relation between an image display position and an angle of convergence.
[Drawing 6]It is a perspective view showing the example of composition which changes an image display position corresponding to operation of the virtual image position regulation knob 18 in drawing 2.
[Drawing 7]It is a perspective view showing the example of composition which changes an image display position corresponding to operation of the virtual image position regulation knob 18 in drawing 2.
[Drawing 8]It is a top view explaining operation of the aspheric surface lens 14 at the time of operating the interpupillary-distance regulation knob 17 of drawing 2.
[Drawing 9]It is a figure explaining the display example of an image display position.
[Drawing 10]It is a figure explaining the display example of an image display position.
[Drawing 11]It is a figure explaining the display example of an image display position.
[Drawing 12]It is a figure explaining the display example of an image display position.
[Drawing 13]It is a flow chart explaining the example of processing at the time of operating the virtual image position regulation knob 18.
[Drawing 14]It is a flow chart explaining the example of processing at the time of operating the virtual image position regulation knob 18.
[Drawing 15]It is a flow chart explaining the example of processing at the time of operating the virtual image position regulation knob 18.
[Drawing 16]It is a flow chart explaining the example of processing at the time of operating the virtual image position regulation knob 18.
[Drawing 17]It is a flow chart explaining the example of processing at the time of operating the virtual image position regulation knob 18.
[Description of Notations]
1 Main part
11 Back light
12 LCD
13 Mirror
14 Aspheric surface lens
15 Half mirror
16 Smoked glass
17 Interpupillary-distance regulation knob
18 Virtual image position regulation knob
31 Earphone
51 Control unit
52 Memory
53 Key unit
55 Memory unit
56 Motor
61 Microphone

6364 sound generation units
71 Image generation unit
75 Monitor
76 Message generation unit
81 Image generation unit
86 Glasses type display
91 Image generation unit
104 Frame
124 LCD holder
132 Sliding plate